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Atmospheric Measurement Techniques Discussions

Interactive comment on "Measurement of relative humidity dependent light scattering of aerosols" *by* R. Fierz-Schmidhauser et al.

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We thank Anonymous Referee #2 for his valuable comments and suggestions, which certainly helped us to improve this paper and make it more concise and better structured. In the following we give detailed answers and explanations to the issues raised.

Comment: Since nephelometers are key instruments for this study a discussion of measurement uncertainties should be given. In Figures A3 and A4 measured and modeled normalized scattering coefficients are shown. It is not clear if measured scattering coefficients were corrected for truncation.

Response: The scattering coefficients are truncation error corrected. We will add this information in the new manuscript.

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Comment: Differences between measured and modeled scattering coefficients can be up to 50% for 300 nm ammonium sulfate particles as shown in Fig. A2. Even if systematic error cancel out when calculating f(RH) uncertainties and systematic errors should be discussed.

Response: For more clarity we will add a sentence on Page 2168, line 24: “These added errors will appear in the figures as the grey regions.” And another sentence on Page 2171, line 10 “The grey line shows predicted values with corresponding uncertainties. The uncertainties are calculated as presented in Sect. 2.2.”

Comment: The temperature difference between nephelometer inlet and sensing volume is about 4.5°C for the unmodified nephelometer (Page 2166, line 10). Are there temperature and RH gradients inside the sensing volume of the non modified DOE/ARM nephelometers?

Response: The thermal gradient across this nephelometer is small. This gradient is about 1.0°C at low RH and about -0.5°C at high RH, meaning that the nephelometer interior is slightly cooler than the nephelometer inlet at high RH values. The humidifier ends at the inlet of the humidified nephelometer, so the nephelometer inlet is warm from the humidifier.

Comment: Does a RH gradient lead to an additional uncertainty in the measured scattering coefficient at high RH?

Response: There is no additional uncertainty in the scattering coefficients due to a RH gradient. But the temperature gradient leads to an uncertainty in RH. We stated that the temperature gradient in the PSI humidified nephelometer is less than 1°C, but was no more than 0.5°C for the salt measurements. For a temperature gradient of 1°C the uncertainty in RH would be smaller than 5.2% at 85% RH, and for 0.5°C this uncertainty shrinks to 2.6%.

Comment: Page 2162, line 14: Measured and modeled scattering coefficients are not

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within the range of uncertainties, as shown in Figure A2. The measurement points RH3 and RH2 are named “exit of humidifier” (page 2167 line 4) and “after humidifier” (Figure A1), respectively. This naming could cause confusion.

Response: We will change this sentence to “after the humidifier (at RH3) the . . .”

Comment: Page 2167, line 3: “...and the RH within the instrument is monotonously rising to the entrance of the nephelometer...” In Figure A1a the RH is slightly decreasing between measurement points “before dryer” and “in nephelometer”.

Response: Even if the dryer is turned off, it still dries the air very little. This is not relevant for the whole measurement, since it is within the uncertainties of the RH. However, we will change the sentence to: “Hydration is when the dryer is turned off and the RH between the entrance of the dryer and the entrance of the nephelometer is not changing within more than 3%.“

Comment: Page 2171, line 8: Which uncertainties are included in the 10% uncertainty? Calculation of f(RH) can compensate for some systematic uncertainties, e.g. the uncertainty in nephelometer calibration.

Response: According to Anderson et al., 1996, the 10% uncertainty includes the non idealities in the wavelength and angular sensitivities of the nephelometer.

Comment: Page 2171, line 18: Does that mean “... are in agreement with the model ...”

Response: We will change the sentence to: “The measurements agree with the model prediction within their rather large uncertainties.” We calculated the differences between theory and measurements and we will state these values in the new manuscript.

Comment: Page 2172, line 15: Why are differences attributed to sampling losses? The differences are smaller than the measurement uncertainties of 10% (page 2171, line 9).

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Response: We know that there are small losses in the sampling lines and they were quite constant over time, so we can correct for them, which is also important to get a f(RH) which is equal to unity at low RH.

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